Effects of Regional Dialect on Word-Final Consonant Voicing

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Background

Phonological Voicing

Stops and fricatives are types of obstruents (i.e.sounds that make an obstruction in the vocal tract).

stops		fricatives	
phonologically voiced	phonologically voiceless	phonologically voiced	phonologically voiceless
bu**d**	bu**t**	bu**zz**	bu**s**

Table 1. Examples of monosyllabic words ending in voiced and voiceless stops and fricatives.

Phonetic Implementation of Voicing Cues

Word-final obstruents in English use two types of cues to signal the voicing feature:

Voiced Consonants | Voiceless Consonants

temporal cue - vowel duration and consonant duration (House, 1961; Klatt,1976, Port & Darby, 1982)

non-temporal cue - glottal pulsing during consonant (Fowler, 1991)

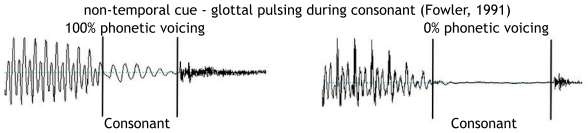


Fig 1 - Examples of the temporal and non-temporal cues to phonological voicing

Previous Studies

Much of what is known about the ways in which American English regional dialects differ has to do with vowels (Thomas, 2001; Labov et al., 2006).

Byrd (1994) showed that there is also consonant variation across regional dialects with her investigation into stop releases and flapping, among other things.

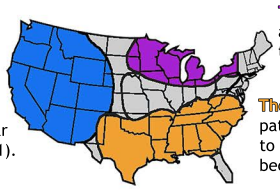
Purnell et al. (2005,2012) investigated word-final obstruent devoicing in varieties of Wisconsin English spoken in historically German settled regions. They found that speakers from these regions produced **a smaller phonetic voicing distinction** than English-speaking immigrant settled areas.

Research Question

To what extent do the voicing distinctions for Northern, Southern, and Western talkers vary in their usage of the temporal and non-temporal cues to voicing for word-final stops and fricatives?

Predictions

The Western dialect will show similar voicing distinctions to the Northern dialect because they are temporally similar (Clopper & Smiljanic, 2011).



The Northern dialect will have a smaller voicing distinction than the other two dialects.

The Southern dialect will pattern differently compared to the other two dialects because it is temporally dissimilar.

Fig 2. Map of dialect regions examined from The Nationwide Speech Project corpus

Methods

Speech was used from The Nationwide Speech Project corpus (Clopper & Pisoni, 2006)

Target words were monosyllabic words ending in phonologically **voiced and voiceless stops or fricatives.**

Tokens were taken from recordings of spontaneous **interview speech**.

Cues Calculated

Temporal cue : Vowel duration to consonant duration ratio
(vowel duration)/(closure or frication duration)

Non-temporal cue : Percentage of phonetic voicing during consonant
(closure voicing or frication voicing duration)/(closure or frication duration)

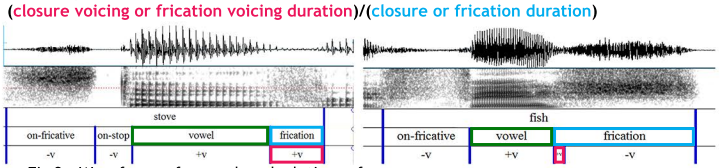


Fig 3. Waveforms of example calculations of cues

Total of 551 tokens were analyzed
voiced tokens per talker mean = 6.60 (sd = 3.02)
voiceless tokens per talker mean =11.77 (sd = 5.69)

10 **Northern dialect** talkers (5 male | 5 female)
10 **Southern dialect** talkers (5 male | 5 female)
10 **Western dialect** talkers (5 male | 5 female)

Results

Linear mixed effects models were used to analyze the data. Models were built with random dialect slopes for token, random intercepts for token, random phonological voicing category slopes for talker and random intercepts for talker.

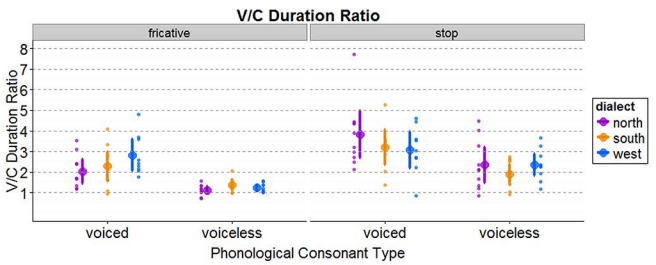


Fig 4 - V/C Duration Ratio

V/C ratios
Voiced > Voiceless (β = -1.42, SE = 0.36, |t| = 3.94)
Stops > Fricatives (β = 1.27, SE = 0.50, |t| = 2.54)

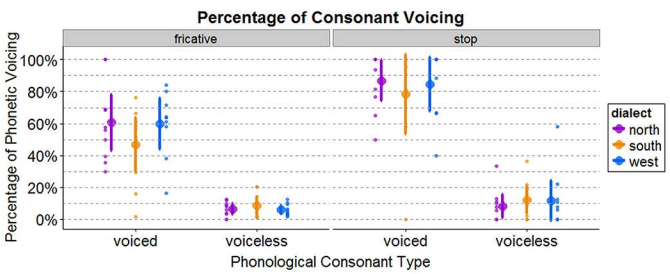


Fig 5 - Percentage of Voicing

Percentage of Consonant Voiced
Voiced > Voiceless (β = -0.54, SE = 0.07, |t| = 7.71)
Stops > Fricatives (β = 0.41, SE = 0.07, |t| = 5.86)

Stop voicing distinction > fricative voicing distinction (β = -0.35, SE = 0.06, |t| = 5.83).

Western voicing distinction > Southern voicing distinction (β = 0.18, SE = 0.08, |t| = 2.25)
Marginally greater Northern voicing distinction than Southern voicing distinction (β = -0.17, SE = 0.09, |t| = 1.89)

Discussion

Both the temporal and non-temporal cues distinguish phonological voicing across dialects and in both consonant types.

- This redundancy of both cues signaling voicing is consistent with Lisker's (1986) argument that no single cue alone signals voicing.

Unexpectedly, there was a difference in the way that the voicing distinction was maintained for stops and friciatives, with the stops having the larger distinction.

Only in the non-temporal cue data do we see regional dialect variation with the Southern talkers making less of a distinction between voiced and voiceless consonants than the Northern talkers.

- This is surprising since one might expect the Northern talkers to make the smaller distinction according to Purnell et al.'s results.
- It is consistent, however, with the South being a marked dialect in terms of vowels and temporal properites.

Future research includes examining individual differences of talkers for evidence of regional dialect variation. Also, including speech from both stops and fricatives from various other types of speech (e.g. read speech.)

References
Byrd, D. (1994). Relations of sex and dialect to reduction. Speech Communication,(15):39-54.
Clopper, C. G. & Pisoni, D. B. (2006). The Nationwide Speech Project: A new corpus of American English dialects. Speech Communication, 48:633-644.
Clopper, C. G. & Smiljanic, R. (2011). Regional variation in temporal organization in American English. Columbus, OH. Ilse Lehiste Memorial Symposium: Melody and Meter
Fowler, C. A. (1991). Vowel duration and closure duration in voiced and unvoiced stops: There are no contrast effects here. Haskins Laboratories Status Report on Speech Research, 107/108:123-140.
House, A. S. (1961). On vowel duration in English. Journal of the Acoustical Society of America.
Jacewicz, E., Fox, R. A., & Lyle, S. (2009). Variation in stop consonant voicing in two regional varieties of American English. Journal of the International Phonetic Association, 39(3), 313.
Klatt, D. H. (1976). Linguistic uses of segmental duration in English: Acoustic and perceptual evidence. Journal of the Acoustical Society of America, 59:1208-1221.
Labov, W., Ash, S., & Boberg, C. (2006). The Atlas of North American English. Mouton de Gruyter, Berlin.
Lisker, L. (1986). Voicing in English: A catalogue of acoustic features signaling /b/ versus /p/ in trochees. Language and Speech, 29:3-11.
Port, R. F. & Dalby, J. (1982). Consonant/vowel ratio as a cue for voicing in English. Perception and Psychophysics, 32:141-152.
Purnell, T., Tepeli, D., & Salmons, J. (July 01, 2005). German Substrate Effects in Wisconsin English: Evidence for Final Fortition. American Speech, 80, 2, 135-164.
Purnell, T., Raimy, E., & Salmons, J. (2012). Obstruent change in the upper midwest: Wisconsin final laryngeal distinctions. In New Ways of Analyzing Variation 41st Annual Conference, Indiana University Bloomington, IN
Thomas, E. (2001). An Acoustic Analysis of Vowel Variation in New World English. Number 85 in Publication of the American Dialect society. Duke University Press.

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